Department of Energy
Washington, DC 20585

January 16, 2009

Dear ENERGY STAR Stakeholders:

Please find attached draft criteria for ENERGY STAR Integral LED Lamps. DOE is providing this draft as the basis for initial review and dialogue with stakeholders, and anticipates the need for substantial engagement by industry, energy efficiency programs, researchers, and other interested parties to address specific issues raised by the rapid proliferation of integral LED lamps. DOE invites stakeholder review and comments on these draft criteria through **February 27, 2009**. All comment letters received by the due date will be posted on the ENERGY STAR website.

This letter provides context for the inclusion of integral LED lamps in the ENERGY STAR program; an overview of the approach; several key issues on which DOE would especially like to engage stakeholders; and the expected timeline for revision and finalization of these criteria.

RATIONALE FOR INTEGRAL LED LAMP CRITERIA

An integral LED lamp[1] is a lamp with LEDs, an integrated LED driver, and an ANSI standardized base designed to connect to the branch circuit via an ANSI standardized lamp holder/socket. DOE has initiated the development of criteria for integral LED lamps for several reasons:

1) On measures of light output, luminous efficacy, optical control, color quality, and thermal management, LED technology has advanced such that integral LED lamps are now emerging as technically and commercially viable products. For some, but not yet all lamp categories, integral LED lamps can now or soon will be capable of producing light output, color quality, and beam characteristics similar to standard incandescent lamps they are intended to replace, with luminous efficacy similar to CFLs.
2) However, currently available integral LED lamps exhibit a very wide range of performance and quality; many of these products perform poorly on one or more measures and clearly do not meet their performance claims. This situation indicates an urgent need for performance guidance to minimize long-term market damage caused by poor-performing products.
3) Energy efficiency program sponsors nationwide have repeatedly stated their need for minimum performance guidance for integral LED lamps, based on concerns regarding poor performance, lack of testing and performance validation for existing products, and the need to verify energy savings.

[1] ANSI/IESNA RP-16-05, Addendum "a". Nomenclature and Definitions for Illuminating Engineering. IESNA. 2008.

4) Setting ENERGY STAR program performance requirements for integral LED lamps now, at the early stages of their market viability, provides important market information. For manufacturers, the program requirements establish performance targets for products under development. For buyers, the requirements provide assurance that products meeting these requirements will perform similarly to the incandescent products they are intended to replace in terms of light quality and distribution, and as well or better than CFL alternatives in terms of energy performance.

OVERALL APPROACH

DOE's approach in developing performance criteria for integral LED lamps is based on the following overall objectives and principles:

1) Integral LED lamps claiming to replace existing standard incandescent or halogen lamps should be very similar to the lamps they purport to replace, in terms of light output, intensity distribution, color characteristics, and lamp dimensions. If product packaging and marketing material indicate equivalency to standard lamp types, consumers and specifiers should be assured the integral LED lamp will closely approximate the claimed level of performance and physical format.
2) However, equivalency to existing standard lamp types, formats, and distributions should not inhibit innovation and creativity in applying LED technology to meet lighting needs. These draft criteria allow for integral LED lamps that do not conform to existing standard lamp types, but restrict the equivalency claims allowed for such products. DOE seeks particular stakeholder engagement on this topic (see Key Issues section below).
3) Integral LED lamps should provide significant energy savings compared to the incandescent and halogen sources they are intended to replace. For those lamp types for which CFLs are a good substitute (e.g., general service A, G, P, and other omnidirectional lamp types), ENERGY STAR qualified integral LED lamps should have luminous efficacy at least equivalent to ENERGY STAR qualified CFLs for similar light output levels. CFLs are often not a viable alternative for some incandescent and halogen sources, especially directional lamps (PAR, MR) and small decorative lamps (B, C, F, etc.). Therefore, the minimum luminous efficacy levels for directional and decorative lamp types proposed in this draft are lower than for lamp types that would compete directly with CFLs. This will allow earlier market participation by these types of LED integral lamps, and result in earlier significant energy savings relative to the incandescent lamps they replace.

KEY ISSUES

DOE invites industry and other stakeholder input on all aspects of the integral LED lamps criteria, but would like to highlight several in particular. These are summarized briefly below:

1. Dimming

Dimming is frequently desired in residential applications. Incandescent lamps are fully dimmable with inexpensive dimming controls. Further, incandescent sources have "set the bar" for consumer expectations of desired dimming performance, in terms of continuity, range, and color shift (i.e., they get warmer/redder at lower light levels). Incompatibility of electronically-ballasted CFLs with existing dimming controls has been one of the key market and application problems for that light source.

Unfortunately, although LEDs are fully dimmable when paired with appropriate dimming controls designed to work with the LED driver, LED products face a similar challenge as CFLs with regard to the existing installed stock of residential dimmers. While some LED products work well with some dimmers, the wide variety of currently installed dimmers confounds efforts to design LED products guaranteed to dim well in every installation. Further, many existing dimmers have minimum electric load requirements that exceed LED product load, resulting in failed dimming.

Against this background, DOE poses several questions:

a) Is it possible to define a common protocol for LED products that would ensure acceptable dimming performance on most currently installed residential dimming controls?
b) Is it necessary to transition to new "LED-compatible" dimmers as more LED products come to market?
c) How can DOE and the ENERGY STAR program best facilitate progress and improvement in the area of LED-dimmer compatibility?

2. Non-Standard Lamps

As stated previously, DOE seeks to structure the integral LED lamp program requirements in a manner that does not stifle innovation. For lamps explicitly sold as replacements for existing incandescent lamp forms, consumer and specifier expectations will require those lamps to produce light quantity, quality, and intensity distributions similar to the incandescent lamps they are intended to replace. But non-standard lamp forms may also provide high quality, energy-efficient lighting service. DOE seeks stakeholder input on how the criteria could be structured to encourage innovation while ensuring consumer and specifier expectations are met. For example:

a) Should luminous intensity distribution requirements be specified for non-standard lamps? Minimum luminous flux levels?
b) How can non-standard lamp performance be communicated to the buyer without creating false expectations? (For example, even the statement of wattage equivalency -- "replaces 60-watt bulb" -- implies the lamp will look and perform like an A19 incandescent.)

c) How can DOE allow for non-standard lamp forms without creating a loophole through which products sold as replacement lamps can circumvent the requirements of standard lamp forms?

3. Low-Voltage MR16s

LED replacements for MR16 halogen lamps are increasingly available on the market, and stakeholder input indicates this application is of great interest. MR16 lamps are small (two inch diameter) reflector lamps used in many spotlighting, accent, display, and other targeted lighting applications, both in residential and commercial settings. MR16s are available for low voltage (12 to 20 volts DC) as well as line voltage (120 V AC) operation. Lamps intended for use with a low voltage transformer have a GU5.3 or GX 5.3 ANSI base and use direct current, while line voltage MR16s typically use a GU10 base and operate on alternating current. While low voltage is the more common operating scenario for MR16s, this introduces a challenge for LED replacement lamps for the following reason: existing low voltage transformers are designed for a target "load" or wattage, e.g., a series of 50-watt MR16 lamps. Electronic transformers operate optimally at greater than 60% of maximum load. If LED MR16s are installed in an existing low voltage lighting system, their wattage is often well below the level needed for the existing electronic transformer to operate.

DOE seeks industry and stakeholder input on how to avoid problems potentially caused by installation of LED MR16 replacement lamps in existing low voltage lighting systems and not meeting minimum load requirements.

4. Reliability Testing

Lumen maintenance (LM-80) test data provided for LED packages used in qualified integral LED lamps will provide important information about expected life of the products. However, this is only part of the story. In integral LED lamps, the LEDs, optics, heat sink material, drivers, and other electronics are packaged in relatively compact housings and in close proximity to one another. This presents significant challenges for effective thermal management and overall system reliability. DOE would like to require reliability testing above and beyond LM-80 test results for the LED packages used in the integral LED lamp. This testing would be conducted on the integral lamp as a whole and would involve testing under high temperature conditions. DOE seeks stakeholder input on several aspects of this requirement, including the following:

a) What kinds of requirements should be considered to minimize the likelihood of premature failure of ENERGY STAR qualified integral LED lamps?
b) What duration of testing is adequate to verify long-term performance?

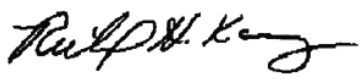
EXPECTED TIMELINE

DOE anticipates active stakeholder review and commentary related to the draft integral LED lamp criteria. To accommodate the expected level of stakeholder engagement, DOE plans a two draft process, roughly as follows:

Jan 2009 – First draft integral LED lamp criteria published
Feb 2009 – Stakeholder review and comments received
Apr 2009 – Second draft criteria published
May 2009 – 2nd round stakeholder comments received
July 2009 – Final criteria published

DOE appreciates the on-going level of stakeholder interest in the ENERGY STAR program, and looks forward to a substantive dialogue regarding the integral LED lamp criteria.

Sincerely,



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